
CLAIMS

[Claim(s)]
[Claim 1] The movable object which has a holder holding the optic and said optic for irradiating an optical spot at the recording surface of the disk with which information is recorded etc., In the optic driving gear which consists of a driving means which drives said good dynamic body to the 2-way of the direction which intersects perpendicularly with radial [of said disk], and a disk flat surface, a support means which supports said good dynamic body movable to the above-mentioned 2-way Said support means is an optic driving gear characterized by having at least two or more plates which have elasticity, and said plate not being parallel to said disk.
[Claim 2] The optic driving gear according to claim 1 with which the include angle of the cross direction of said plate and said disk flat surface to make is characterized by the respectively equal thing.
[Claim 3] The optic driving gear according to claim 1 characterized by a plane of composition with said good dynamic body of said plate and a plane of composition with the holddown member of said plate not being parallel.
[Claim 4] The optic driving gear according to claim 1, 2, or 3 characterized by fixing viscous material to said all or some of plates.
[Claim 5] The optic driving gear according to claim 1, 2, or 3 characterized by the thickness of said plate and the ratio of width of face being 7% or more.
[Claim 6] The optic driving gear according to claim 5 characterized by said plate having at least one or more narrow-width sections.
[Claim 7] The optic driving gear according to claim 6 with which said narrow-width section is characterized by being in two edges near the installation part with said good dynamic body and said holddown member of said plate at least.
[Claim 8] The optic driving gear according to claim 1, 2, or 3 characterized by having plane of symmetry including the optical axis with which said support means carries out outgoing radiation, and reaches a record medium from the light source.
[Claim 9] The optic driving gear according to claim 1, 2, or 3 characterized by being the arrangement which has vertical plane of symmetry to a flat surface including the optical axis with which said support means carries out outgoing radiation, and reaches a record medium from the light source.
[Claim 10] The optic driving gear according to claim 1, 2, or 3 characterized by said plate and at least four or more reinforcement members constituting said support means.
[Claim 11] The movable object which becomes the recording surface of the disk with which information is recorded from the holder holding an optic and said optics, such as a luminescence means for irradiating an optical spot, a light-receiving means, and a condensing means, The driving means which drives said good dynamic body to the 2-way of the direction which intersects perpendicularly with radial [of said disk], and a disk flat surface, In the optic driving gear which consists of a support means which supports said good dynamic body movable to the above-mentioned 2-way with elasticity, a wiring means to connect with an external circuit from a movable object, etc. The optic driving gear characterized by having two or more wiring members by which said wiring means connects an end to said luminescence means, said light-receiving means, said driving means, and the electric target of said good dynamic body, and connects the other end to the external circuit and the electric target of said optic driving gear, and each wiring member having two or more wiring.
[Claim 12] The optic driving gear according to claim 11 characterized by having consisted of said wiring with which said wiring member consists of a wire rod of a conductor, and an insulator with which between said wiring and said wiring of two or more is insulated electrically, and forming in tabular [of one].
[Claim 13] The optic driving gear according to claim 12 characterized by unifying said wiring member by applying or printing said insulator.
[Claim 14] The optic driving gear according to claim 12 or 13 characterized by said insulator having viscosity.
[Claim 15] The optic driving gear according to claim 11 characterized by said wiring being the spring material of a copper system.
[Claim 16] The optic driving gear according to claim 12 or 13 characterized by said wiring member having at least one or more narrow-width sections.
[Claim 17] The optic driving gear according to claim 11 characterized by not arranging the electrical signal and the electrical signal from a light-receiving means which drive said driving means in the same wiring member about the electrical signal which flows said two or more wiring.
[Claim 18] The optic driving gear according to claim 11 characterized by not arranging the electrical signal and the electrical signal from a light-receiving means which drive a luminescence means in the same wiring member about the electrical signal which flows said two or more wiring.
[Claim 19] The optic driving gear according to claim 11 characterized by the electrical signal and the electrical signal from a light-receiving means which drive said driving means not adjoining in the same wiring member about the electrical signal which flows said two or more wiring.
[Claim 20] The optic driving gear according to claim 11 characterized by the electrical signal and the electrical signal from a light-receiving means which drive a luminescence means not adjoining in the same wiring member about the electrical signal

which flows said two or more wiring.
[Claim 21] The movable object which has the holder with which an optic and said optics, such as a luminescence means, a light-receiving means, and a condensing means, are held at least since an optical spot is irradiated at the recording surface of the disk with which information is recorded, In the optic driving gear which consists of a driving means which drives said good dynamic body to the 2-way of the direction which intersects perpendicularly with radial [of said disk], and a disk flat surface, a support means which supports said good dynamic body movable to the above-mentioned 2-way Said support means consists of at least four or more plates which are not parallel to said disk which has elasticity and viscosity. The optic driving gear characterized by having two or more wiring said whose plates connect an end to said luminescence means, said light-receiving means, said driving means, and an electric target, and connect the other end to the external circuit and the electric target of said optic driving gear.
<DP N=0003> [Claim 22] The movable object which has the holder with which an optic and said optics, such as a luminescence means, a light-receiving means, and a condensing means, are held at least since an optical spot is irradiated at the recording surface of the disk with which information is recorded, In the optic driving gear which consists of a driving means which drives said good dynamic body to the 2-way of the direction which intersects perpendicularly with radial [of said disk], and a disk flat surface, a support means which supports said good dynamic body movable to the above-mentioned 2-way Said support means is constituted from a plate of at least four or more sheets which has elasticity, and at least four or more reinforcement members, and said plate is not parallel to said disk. And the plane of composition of said plate and said good dynamic body, The optic driving gear characterized by having two or more wiring which a plane of composition with the holddown member of said plate constitutes being un-parallel, and said plate connects an end to said luminescence means, said light-receiving means, said driving means, and an electric target, and connects the other end to the external circuit and the electric target of said optic driving gear.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] Especially this invention relates to the optic driving gear in an optical recording regenerative apparatus.
[0002].
[Description of the Prior Art] Although the various optic driving gears using a flat spring are used in the conventional optical recording regenerative apparatus, those optic driving gears are supporting the good dynamic body by two pairs of flat springs, as shown in JP,62-20903,Y.
[0003]
[Problem(s) to be Solved by the Invention] However, in the above-mentioned example, the junction supporter material which joins two pairs of flat springs required in order to support a movable object movable to a 2-way became indispensable, and lightweight-ization of a movable object was checked, and there was a problem that dynamic characteristics was unstable, according to complicated structure.
[0004] Moreover, when optical elements, such as a light emitting device and a photo detector, were united with a movable object, there was a problem that electric wiring for these components was indispensable, and became much more complicated structure with unstable dynamic characteristics.
[0005]
[Means for Solving the Problem] The movable object which has a holder holding the optic and said optic for irradiating spot light at the recording surface of the disk with which the information on this invention is recorded etc., The driving means which drives said good dynamic body to the 2-way of the direction which intersects perpendicularly with radial [of said disk], and a disk flat surface, Said support means consists of flat springs of at least four or more sheets in which the optic driving gear which consists of a support means which supports said good dynamic body has elasticity. And it is characterized by for the cross direction of said flat spring having had the include angle of said disk flat surface and arbitration, and constituting said flat spring in the wiring material of various signals, and one.
[0006]
[Example]
(Example 1) The 1st example in this invention is shown in drawing 1 .
[0007] Light 15 generated from the light source 2 is made into parallel light with a collimate lens 3, is refracted after that in the direction which intersects perpendicularly with disk 1 flat surface with the optical-path modification means 4, and forms an optical spot in the location of the arbitration on a recording surface through an objective lens 5 further. However, in order that said disk 1 may move to radial (the direction of tracking and an arrow head 22 show below), and a disk side and a perpendicular direction (the direction of focusing and an arrow head 21 show below) under the effect of the deflection of the main shaft of the main shaft motor 6, the eccentricity of the disk itself, face deflection, etc., the movable object which has an objective lens 5 according to the variation rate is driven.
[0008] Here, said good dynamic body consists of the 2nd coil 9 a-d driven in said objective lens 5, the holder 7 holding it, and coil 8a, b and the direction of tracking of the 1st which drives a movable object in the direction of focusing.
[0009] Moreover, said good dynamic body is supported by the end of flat-spring 10 a-d of four sheets which has elasticity as shown in drawing 2 . At this time, as for flat-spring 10 a-d, that cross direction has include-angle 31 a-d of the flat surface of a disk 1, and arbitration, respectively, and since other ends of flat-spring 10 a-d are being fixed to the base 11, as drawing 3 shows, the flat spring of four sheets becomes movable [deflection and a movable object] to said 2-way at the 2-way of the direction of focusing, and the direction of tracking. Moreover, an include angle 31 improves the rigidity of the flat spring of the circumference of tangent directional axes other than said 2-way of a movable object (for example, said disk).
[0010] Here, the construction material and the configuration of a flat spring 10 are explained. The construction material of a flat spring 10 has the desirable metallic material which has the elasticity of stainless steel, phosphor bronze, beryllium copper, etc., and the cross-section configuration is carrying out 2mm ****** or a trapezoid from 0.005mm in thickness to 1mm, and width of face of 0.1mm. Moreover, although plastic material is sufficient as said flat spring 10, the point of the temperature characteristic or aging to the above metallic materials are more effective.
[0011] Next, an include angle 31 is explained. An include angle 31 influences the load rate of the direction of focusing, and the direction of tracking with the magnitude. That is, as the value of an include angle 31 approaches 0 times, while the load rate of the direction of focusing becomes smaller, the load rate of the direction of tracking becomes large. If an include angle 31 approaches the reverse at 90 degrees, the load rate of the direction of focusing will become large, and the direction of tracking will become small. Here, since said load rate affects greatly the dynamic characteristics of the movable object to the direction of focusing, and the direction of tracking, the value of the include angle 31 which influences it becomes important, all the four value is equal respectively, and 65 degrees is effective [a value] from 25 degrees.
[0012] In addition, although the movable object is supported by the flat spring of four sheets in this example, equivalent

effectiveness is acquired also by constituting the flat spring of four sheets for example, with two components, as shown in drawing 4 .

[0013] Next, a driving means is explained.

[0014] electromagnetism with the magnetic flux generated from the magnet 12 which the 1st coil 8 which drives a movable object in the direction of focusing as drawing 1 shows is carrying out the air core ellipse, and counters — driving force is generated in the direction of focusing according to an operation. The 1st [said] coil 8a and b have fixed one [at a time], respectively to the both-sides side of said holder 7 of the direction along the tangential direction of a disk, and drive a movable object in the direction of focusing with said driving force. moreover, electromagnetism with the magnetic flux which the magnet 12 which the 2nd coil 9 driven in the direction of tracking is carrying out the air core ellipse like the 1st above-mentioned coil 8, and counters generates — a movable object is driven in an operation. Two have fixed a total of four [at a time] to said both-sides side of said holder 7 like [said 2nd coil 9 a-d] the 1st coil, respectively. Moreover, said magnet 12a and b are arranged at the fixed part with the opening of said 1st and 2nd coils 8 and 9 and a request.

[0015] Here, although said 1st and 2nd coils 8 and 9 roll the metal wire rod which used conductors, such as copper or aluminum, as the main component, effectiveness with the same said of what carried out pattern formation of said electrical conducting material, for example on insulation sheets, such as polyimide resin and polyurethane resin, is acquired. Moreover, although the 1st and 2nd coils 8 and 9 were carried in the holder 7 in this example and the magnet 12 is arranged to the fixed part, it is the same, even if it carries a magnet 12 in a holder 7 and arranges said 1st and 2nd coils 8 and 9 to a fixed part. Moreover, in this example, even if it divides the magnet which drives the actuation to the direction of focusing, and the actuation to the direction of tracking to the above-mentioned 2-way although the magnet 12a [same] and b are used, the same effectiveness is acquired. Furthermore, said 1st coil 8, the 2nd coil 9, and the above-mentioned pattern acquire the same effectiveness also by ******.

[0016] (Example 2) The 2nd example in this invention is shown in drawing 5 .

[0017] The optic which consists of the light source 2, an optical diffraction means 14, and objective lens 5 grade is supported by the holder 7, and constitutes the movable object from the 2nd coil 9 grade driven in said holder 7, the 1st coil 8 driven in the direction of focusing, and the direction of tracking.

[0018] It is condensed with an objective lens 5 and the light generated from the light source 2 forms an optical spot on the recording surface of a disk, after penetrating the optical diffraction means 14. Since the optic from the light source 2 to an objective lens 5 is carried in said holder 7 at this time, even if said good dynamic body displaces in the direction of focusing, or the direction of tracking, change is not produced in the relative position of each optic.

[0019] moreover, the movable object is supported by the flat spring 10 and, as for said flat-spring 10 a-d, the cross direction has said disk flat surface and include angle 31, respectively -- having -- **** -- in addition — and to said flat-spring 10 a-d, damping-material 13 a-d which has viscosity has fixed. The same effectiveness as an example 1 is acquired also by this.

[0020] Here, said damping material 13 is explained. Said damping material 13 controls the unnecessary deformation energy of said flat spring 10 accompanying the variation rate of said good dynamic body by the viscous drag of a damping material 13 by using silicone rubber, natural rubber, and isobutylene isoprene rubber and ether system polyurethane as the principal component. By the way, although said damping material 13 may fix to all of said flat springs 10, effectiveness is acquired even if it fixes only to a part. Moreover, the same effectiveness as the above-mentioned is acquired also by being filled up with said damping material between the flat springs of two sheets, as drawing 6 shows. Furthermore, the same effectiveness is acquired also by being filled up with the part between flat springs.

[0021] (Example 3) The 3rd example in this invention is shown in drawing 7 .

[0022] The end of said flat-spring 10 a-h of four sheets and a total of eight sheets is fixed, respectively to the both-sides side of the holder 7 which constitutes said good dynamic body which was along the tangential direction of said disk, and other ends of said flat-spring 10 a-h are fixed to a fixed part, respectively. At this time, as for said flat-spring 10 a-h, that cross direction has the flat surface and include angle 31 of said disk. Also by this, the same effectiveness as an example 1 is acquired. Moreover, the same effectiveness as **** is acquired also by forming the flat spring of two sheets whose longitudinal direction corresponds, for example, 10a and 10e, by the flat spring of one sheet, and forming other flat springs of six sheets by the flat spring of three sheets similarly, respectively.

[0023] (Example 4) The 4th example in this invention is shown in drawing 8 .

[0024] Flat-spring 10 a-d of four sheets which fixed so that the cross direction might have said disk flat surface and said include angle 31 sets at some or all between said holders 7 and said bases 11. The longitudinal direction is not parallel to the tangential direction (an arrow head 23 shows) of said disk, and as shown in drawing 8 (b), when [as shown in drawing 8 (a), when it sees from a top face, and] it sees from a side face, the flat spring 10 on either side is arranged on ** Ha's handwriting, respectively. Also in this structure, the same effectiveness as an example 1 is acquired. Moreover, although a base 11 side is broad in this example, it is the same even if it narrows a base 11 side for a holder 7 side broadly.

[0025] In addition, although explained as an example of this invention taking the case of the case of the optic driving gear in an optical recording regenerative apparatus, the same effectiveness is acquired also in the optic driving gear used for various devices.

[0026] (Example 5) Drawing 9 (a) is the schematic diagram of the 5th example in this invention.

[0027] The holddown member 109 is carrying out movable support of the movable object 101 equipped with the optical unit 102, reflex systems 103, a lens 104, and a coil 106 through four flat springs 105a, 105b, 105c, and 105d (it has illustrated to drawing 9 (b).). The light which carried out outgoing radiation condenses from the optical unit 102 to a record medium (not shown) through a lens 104 toward a lens 104 by reflex systems 103. Light including the recording information reflected from the record medium follows the aforementioned optical path conversely, and return and an optical unit generate an electric signal to the optical unit 102 from the light which returned. Based on this electrical signal, position control of a movable object is performed using the electromagnetic force generated between a coil 106 and a magnet 107 according to the current which flows in a coil 106.

[0028] Drawing 10 is the explanatory view of this example, and in order to explain actuation of a flat spring 105, it is simplified and illustrated. Drawing 10 (a) shows the condition of a center valve position. At this time, deformation of flat springs 105a,

105b, 105c, and 105d is small.

[0029] On the other hand, drawing 10 (b) shows the condition of having displaced in the direction of an arrow head 201 as an example among the direction of focusing which the movable object 101 can move, and the direction of tracking. At this time, flat springs 105a, 105b, 105c, and 105d deform in the deformation mode which bent with torsion deformation respectively and compounded deformation.

[0030] It turned out at the time of work of this example that behavior changes greatly with the width of face and thickness of each flat spring in such deformation mode. Then, when die-length L of a flat spring was 8 or more times of width of face W as shown in drawing 11 as a result of advancing an experiment, when oblateness (the ratio of thickness T to width of face W = T/W) was 7% or more of configuration, the behavior of a flat spring was stabilized, and when oblateness was 7% or less of configuration, it discovered that the behavior of a flat spring became unstable. Furthermore, as shown in the table of drawing 11 , when oblateness was 16% or more, that stability improves extremely also discovered.

[0031] Drawing 12 is the application of the flat spring in this example. The slash sections are the movable object 101 and an installation part with a holddown member 109. Drawing 12 (a) has shown die-length L and width of face W which were shown by drawing 11 , and this is the simplest implementation configuration.

[0032] Drawing 12 (b) is an application with the small width of face W2 of the straight-line part of the center of a flat spring to the width of face W1 of an installation part. When thickness T of a flat spring uses a comparatively large ingredient, this is effective in order to prevent the nonconformity of actuation by the rigidity of a flat spring becoming high. The oblateness concerning the stability of the behavior at this time is T/W2.

[0033] Drawing 12 (c) is an application which has the narrow-width section with narrow width of face in the both ends of a flat spring to width-of-face W3 of the straight-line part of the center of a flat spring. When thickness T of a flat spring uses a comparatively small ingredient, this is effective in order to prevent the nonconformity of actuation by the rigidity of a flat spring becoming low. The oblateness concerning the stability of the behavior at this time is T/W4.

[0034] Drawing 12 (d) is an application which does not fix width of face of the flat-spring center section of drawing 12 (c). Although the width of face of a center section is changing from W5 to W4, since this is effective in distributing the resonant frequency of a flat spring and has the effectiveness which makes low the peak of the amplitude in a natural-frequency frequency, it is control top validity.

[0035] Drawing 13 is the application of this example and combines the flat spring of drawing 12 (c). The condition of having displaced in the direction of an arrow head 501 as an example among the direction of focusing which the movable object 101 can move, and the direction of tracking is shown. At this time, narrow-width section 502a twists and deforms a flat spring, and center-section 502b bends and deforms it. Thus, while deformation mode distributes and actuation is stabilized by preparing the narrow-width section in the ends of a flat spring, linearity operating range spreads. Moreover, in this application, to the resonant frequency, the simple effect of bending rigidity was dominant, the rigidity considered on a design bent and it was checked as a result of the experiment that rigidity is sufficient.

[0036] Drawing 14 is an example of wiring which lets the inside of the flat spring in this example pass. As shown in drawing 14 (a), wiring 601 is located in a line with the flat spring 105 toward the other end at abbreviation parallel from the end of the 4 flat spring 105. As this wiring 601 is fabricated by etching from the foil of the copper alloy spring ingredient containing beryllium and it is shown in the sectional view of drawing 14 (b), a cross-section configuration is an abbreviation rectangle.

[0037] As shown in drawing 14 (b), the appearance of the flat spring 105 of this example is fabricated by applying polyimide resin from both sides of wiring. The activity of the ingredient which has insulation besides polyimide resin is possible for an ingredient. Moreover, the manufacture approach is possible also by attachment of a sheet-like ingredient and injection molding in addition to spreading of resin.

[0038] Furthermore, it is also possible to combine with wiring with which the laminating of the wiring 601 is carried out as shown in drawing 14 (c) as an example, and the cross sections differ like wiring 601a.

[0039] Although wiring 601 may be exposed to an appearance end face in the narrow-width section 602 of the flat spring 105 shown in drawing 14 (a), since four flat springs 105 do not contact mutually, they are satisfactory.

[0040] Four of a total of the-16 wiring 601 in this example are in each of four flat springs 105. Although flat springs 105a, 105b, 105c, and 105d are small since they have deviated as shown in drawing 9 (b), between the wiring 601 of four in a flat spring 105 which approached, it is [electric] easy to be influenced. [of the electric effect between flat springs] Then, the signal line with which current level called the light source actuation signal line inputted into the light-receiving signal line outputted from the optical unit 102 in this example and the optical unit 102 and the coil actuation signal line which supplies a current to the coil 106 which drives the movable object 101 differs is not arranged in the same flat spring. The light-receiving signal line was specifically packed into flat springs 105c and 105d, the light source actuation signal line was packed into flat-spring 105b, and the coil actuation signal line is collectively arranged to flat-spring 105a. Thus, control action stabilized by arranging a signal line was realized.

[0041] (Example 6) Drawing 15 is the 6th example in this invention.

[0042] As shown in drawing 15 (a), flat-spring 701 a-d of this example is carrying out movable support of the movable object 703 at the 2-way of the direction of focusing (arrow head 21), and the direction of tracking (arrow head 22) at the holddown member 702.

[0043] The description of this example is in how to attach this flat-spring 701 a-d. Joining the edge by the side of the holddown member 702 of flat-spring 701 a-d to an end face vertical to the direction of tracking of a holddown member 702, about 90 degree of flat-spring 701 a-d are twisted toward the movable object 703 from a holddown-member 702 side, and it joins the other end of flat-spring 701 a-d to an end face vertical to the direction of focusing of the movable object 703. The configuration where the torsion of flat-spring 701a was seen from the arrow head 704 is shown in drawing 15 (b).

[0044] In this example, flat-spring 701 a-d of four sheets is arranged so that it may have plane of symmetry vertical to plane of symmetry vertical to the direction of tracking, and the direction of focusing.

[0045] Drawing 16 is the explanatory view of this example of operation. Drawing 16 (a) A holddown-member 702 side is fixed respectively and - (c) shows the condition of flat-spring 701a when the movable object 703 side displaces in the direction of arrow heads 801, 802, and 803.

[0046] the variation rate of arrow-head 801 direction — flat-spring 701a — mainly — near the movable object 703 side-edge section — bending — deforming — the variation rate of arrow-head 802 direction — flat-spring 701a — mainly — near the holddown-member 702 side-edge section — bending — deforming — the variation rate of arrow-head 803 direction — flat-spring 701a — mainly — a variation rate — near the center section shown in the location 804 bends and deforms. Thus, since flat-spring 701 a-d has the part which flat-surface bending generates also to all the directions of [within the flat surface made by the direction of focusing which the movable object 703 can move, and the direction of tracking], while becoming possible to drive the movable object 703 with small driving force, the isotropic engine performance can be obtained.

[0047] Moreover, although flat-spring 701 a-d of drawing 15 attaches and it differs from the direction, the same effectiveness is acquired also by joining the edge by the side of the holddown member 702 of flat-spring 701 a-d to an end face vertical to the direction of focusing of a holddown member 702, and joining the other end of flat-spring 701 a-d to an end face vertical to the direction of tracking of the movable object 703.
[0048] Furthermore, arrangement of a flat spring acquires the same effectiveness also by arrangement which extends the holddown-member 702 side in a base 11 side, i.e., this example, like drawing 8 .
[0049] (Example 7) Drawing 17 is the 7th example of this invention.
[0050] It is the description to make this example whenever [smaller than 90 degrees torsion angle] to about 90 degree of flat-spring 701 a-d in the 6th example being twisted. Although this example shows the case of 45 degrees as an example of whenever [torsion angle], a suitable include angle can be chosen according to the need on control.
[0051] Joining the edge by the side of the holddown member 702 of flat-spring 705 a-d to an end face vertical to the direction of tracking of a holddown member 702, about 45 degree of flat-spring 705 a-d are twisted toward the movable object 706 from a holddown-member 702 side, the other end of flat-spring 705 a-d has a flat surface vertical to the direction of focusing of the movable object 706, and the include angle of about 45 degrees, and it joins it to an end face parallel to the tangential direction (arrow head 23) of a disk. The configuration where the torsion of flat-spring 705a was seen from the arrow head 707 is shown in drawing 17 (b). Even if the direction of torsion is reverse, it acquires the same effectiveness.
[0052] Thus, by constituting and setting the torsion angle of a flat spring as a request, since it can perform easily doubling a drive system and the balance of support system rigidity, optimum control becomes possible.
[0053] Moreover, the edge by the side of the holddown member 702 of flat-spring 705 a-d is joined to an end face vertical to the direction of focusing of a holddown member 702, it has the include angle of a flat surface vertical to the direction of focusing of the movable object 706 and a request of the other end, and the same effectiveness is acquired also by joining to an end face parallel to the tangential direction (arrow head 23) of a disk.
[0054] Furthermore, end-face junction is carried out, it has the include angle of a flat surface vertical to the direction of focusing of a holddown member 702 and a request of the other end, and the same effectiveness is acquired for the edge by the side of the movable object 706 of flat-spring 705 a-d also by [vertical to an end face vertical to the direction of focusing of the movable object 706, or the direction of tracking] joining to an end face parallel to the tangential direction (arrow head 23) of a disk.
[0055] (Example 8) Drawing 18 is the 8th example of this invention.
[0056] To the 6th example which has the isotropic engine performance, this example is characterized by adding wire 708 a-d as a reinforcement member, in order to raise rigidity.
[0057] As shown in drawing 18 (a), it joined to the end face vertical to the direction of tracking of a holddown member 702, and about 90 degrees of ends by the side of a holddown member 702 were twisted toward the movable object 709 from the holddown-member 702 side, and they have joined flat-spring 701 a-d to the end face with the other end vertical to the direction of focusing of the movable object 709.
[0058] Moreover, wire 708 a-d joins the end by the side of a holddown member 702 to an end face vertical to the direction of tracking of a holddown member 702, and joins the other end to an end face vertical to the direction of tracking of the movable object 709. Wire 708 a-d has become in parallel with the tangential direction of parallel and media mutually, and has isotropic rigidity to all the directions of [within the flat surface made by the direction of focusing which the movable object 709 can move like flat-spring 701 a-d, and the direction of tracking].
[0059] Drawing 18 (b) is the elements on larger scale of this example seen from the arrow head 710, and shows the physical relationship of flat springs 701a and 701c and Wires 708a and 708c.
[0060] Thus, by constituting, desired rigidity can be acquired with a cheap wire, choosing an advantageous specification ingredient on cost in the flat spring which served as electric wiring.
[0061] (Example 9) Drawing 19 is the 9th example of this invention.
[0062] This example arranges the wiring members 801a and 801b on two side faces of the movable object 709 which carried out movable support by four wire 708 a-d. In such a configuration, the fully small thing of the elasticity of the stability of the engine performance of operation to a wiring member is desirable compared with the elasticity of a wire.
[0063] The wiring member in this example made one the ends of two or more wiring 802 with the insulating material 803, as shown in drawing 19 (b), and low elasticity is realized, arranging the medium insulating material 804 in the medium further, and preventing the contact during each wiring. As long as wiring 802 is a desired cross-section configuration, it may be covered with another insulating material, for example like coat copper wire. Moreover, although the ingredient of wiring 802 is good at an electrical conducting material, for the improvement in endurance, the spring ingredient of a copper system like beryllium copper is desirable.
[0064] Attenuation of an oscillation is raising a scale and stability of operation by using for the medium insulating material 804 the ingredient which has viscosity like rubber.
[0065] Moreover, if the still lower viscous ingredient of elasticity is used for the medium insulator 804, a wrap thing is also possible in the whole wiring 802.
[0066] Next, a signal is described. The actuation signal line to the driving means (not shown) which drives the movable object 709 in this example, and the actuation signal line to the luminescence means within the movable object 709 (not shown) are packed into wiring means 801a, and the signal line from the light-receiving means within the movable object 709 (not shown)

is packed into wiring means 801b, especially the noise to the signal from a light-receiving means is reduced.
[0067]
[Effect of the Invention] As explained above, this invention gave the include angle to the cross direction and the disk flat surface of a flat spring, by having enabled displacement of a movable object to the 2-way of the direction of focusing, and the direction of tracking by the flat spring of a simple configuration, made junction supporter material unnecessary and realized simplification of structure.
[0068] Moreover, when the flat spring which is a support means served as the function of two or more electric wiring, required wiring was able to be lost conventionally apart from the support system. This is very advantageous on cost.
[0069] Since the property was easily changed according to the control objects, such as lowering rigidity by being twisted and using a flat spring in the condition, and giving an anisotropy to rigidity, while optimum control was realizable, the optic driving gear in which the application to a wide range device is possible was realized without changing main configurations.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The perspective view showing the example 1 of this invention.
[Drawing 2] For (a), (b) is the top-face top view showing the example 1 of this invention, and a X-X' sectional view shown by drawing 10 (a).
[Drawing 3] For (a), (b) is the top-face top view showing the actuation condition of the example 1 of this invention, and the side elevation showing the actuation condition of the example 1 of this invention.
[Drawing 4] The perspective view showing an example of the flat spring of the example 1 of this invention.
[Drawing 5] The perspective view showing the example 2 of this invention.
[Drawing 6] The sectional view showing the flat spring of this invention, and the configuration of a damping material.
[Drawing 7] The perspective view showing the example 3 of this invention.
[Drawing 8] For (a), (b) is the top-face top view showing the example 4 of this invention, and the side elevation showing the example 4 of this invention.
[Drawing 9] For (a), (b) is the perspective view showing the example 5 of this invention, and the partial perspective view showing the example 5 of this invention.
[Drawing 10] For (a), (b) is the standby condition explanatory view of the example 5 in this invention, and the displacement condition explanatory view of the example 5 in this invention.
[Drawing 11] The explanatory view of the oblateness in this invention.
[Drawing 12] (a), (b), (c), and (d) are outline drawing of the flat-spring application in this invention.
[Drawing 13] The application explanatory view of the example 5 in this invention.
[Drawing 14] For (a), the plugging chart of the flat spring in this invention, (b), and (c) are the sectional view of the flat spring in this invention.
[Drawing 15] (a) and (b) are the explanatory view of the example 6 in this invention.
[Drawing 16] (a), (b), and (c) are the explanatory view of the example 6 in this invention of operation.
[Drawing 17] (a) and (b) are the explanatory view of the example 7 in this invention.
[Drawing 18] For (a), the explanatory view of the example 8 in this invention and (b) are the elements on larger scale of the example 8 in this invention.
[Drawing 19] (a) and (b) are the explanatory view of the example 9 in this invention.
[Description of Notations]
1 Disk
2 Light Source
3 Collimate Lens
4 Optical-Path Modification Means
5 Objective Lens
6 Main Shaft Motor
7 Holder
8 1st Coil
9 2nd Coil
10 Flat Spring
11 Base
12 Magnet
15 Light
21 The Direction of Focusing
22 The Direction of Tracking
23 Tangential Direction of Disk

[Translation done.]

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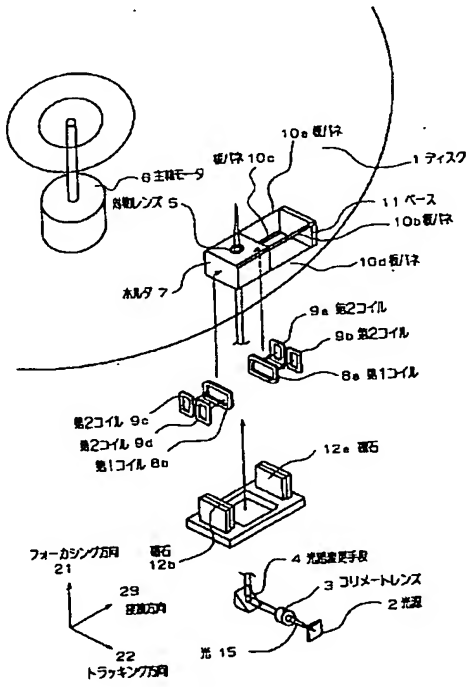
(54)【発明の名称】　光学部品駆動装置

(57)【要約】

【目的】　本発明は対物レンズ等の光学部品をディスクの変位にあわせて駆動する光学部品駆動装置に適用される。目的は、板バネによりフォーカシング，トラッキングの２方向に駆動させることと、板バネに配線機能を持たせることにより装置の簡素化をはかり、可動体の軽量化により高速かつ安定駆動を行うことにある。

【構成】　板バネとディスクが非平行となる様に板バネを配置する。



【特許請求の範囲】

【請求項１】　情報が記録されているディスクの記録面に光スポットを照射するための光学部品と前記光学部品を保持するホルダ等を有する可動体と、前記可動体を前記ディスクの半径方向及びディスク平面と直交する方向の２方向に駆動する駆動手段と、前記可動体を前述の２方向に移動可能に支持する支持手段などからなる光学部品駆動装置において、
前記支持手段は弾性を有する少なくとも２枚以上の板を有し、前記板が前記ディスクと非平行である事を特徴とする光学部品駆動装置。

【請求項２】　前記板の幅方向と前記ディスク平面とのなす角度がそれぞれ等しい事を特徴とする請求項１記載の光学部品駆動装置。

【請求項３】　前記板の前記可動体との接合面と、前記板の固定部材との接合面とが非平行である事を特徴とする請求項１記載の光学部品駆動装置。

【請求項４】　前記板の全部または一部に粘性材を固着した事を特徴とする請求項１または請求項２または請求項３記載の光学部品駆動装置。

【請求項５】　前記板の厚さと幅の比が７％以上であることを特徴とする請求項１または請求項２または請求項３記載の光学部品駆動装置。

【請求項６】　前記板が少なくとも１箇所以上の狭幅部を有することを特徴とする請求項５記載の光学部品駆動装置。

【請求項７】　前記狭幅部が、少なくとも前記板の前記可動体及び前記固定部材との取り付け部分近傍の端部２箇所にあることを特徴とする請求項６記載の光学部品駆動装置。

【請求項８】　前記支持手段が、光源より出射し記録媒体に到達する光軸を含む対称面を有することを特徴とする請求項１または請求項２または請求項３記載の光学部品駆動装置。

【請求項９】　前記支持手段が、光源より出射し記録媒体に到達する光軸を含む平面に対して垂直な対称面を有する配置であることを特徴とする請求項１または請求項２または請求項３記載の光学部品駆動装置。

【請求項１０】　前記板と少なくとも４本以上の補強部材が前記支持手段を構成する事を特徴とする請求項１または請求項２または請求項３記載の光学部品駆動装置。

【請求項１１】　情報が記録されているディスクの記録面に光スポットを照射するための発光手段、受光手段、集光手段などの光学部品と前記光学部品を保持するホルダとからなる可動体と、前記可動体を前記ディスクの半径方向及びディスク平面と直交する方向の２方向に駆動する駆動手段と、前記可動体を弾性をもって前述の２方向に移動可能に支持する支持手段と、可動体から外部回路へ接続する配線手段などからなる光学部品駆動装置において、
前記配線手段が一端を前記可動体の前記発光手段、前記受光手段、前記駆動手段と電気的に接続し、他端を前記光学部品駆動装置の外部回路と電気的に接続する複数の配線部材を有し、かつ各々の配線部材が複数の配線を有する事を特徴とする光学部品駆動装置。

【請求項１２】　前記配線部材が導電体の線材からなる前記配線と、複数本の前記配線と前記配線間を電気的に絶縁する絶縁体とからなり、一体の板状に形成した事を特徴とする請求項１１記載の光学部品駆動装置。

【請求項１３】　前記絶縁体を塗布または印刷する事により前記配線部材を一体化することを特徴とする請求項１２記載の光学部品駆動装置。

【請求項１４】　前記絶縁体が粘性を有する事を特徴とする請求項１２または請求項１３記載の光学部品駆動装置。

【請求項１５】　前記配線が銅系のバネ材であることを特徴とする請求項１１記載の光学部品駆動装置。

【請求項１６】　前記配線部材が少なくとも１箇所以上の狭幅部を有していることを特徴とする請求項１２または請求項１３記載の光学部品駆動装置。

【請求項１７】　複数の前記配線を流れる電気信号について、前記駆動手段を駆動する電気信号と受光手段からの電気信号を同一配線部材中に配置しないことを特徴とする請求項１１記載の光学部品駆動装置。

【請求項１８】　複数の前記配線を流れる電気信号について、発光手段を駆動する電気信号と受光手段からの電気信号を同一配線部材中に配置しないことを特徴とする請求項１１記載の光学部品駆動装置。

【請求項１９】　複数の前記配線を流れる電気信号について、前記駆動手段を駆動する電気信号と受光手段からの電気信号が同一配線部材中において隣接しないことを特徴とする請求項１１記載の光学部品駆動装置。

【請求項２０】　複数の前記配線を流れる電気信号について、発光手段を駆動する電気信号と受光手段からの電気信号が同一配線部材中において隣接しないことを特徴とする請求項１１記載の光学部品駆動装置。

【請求項２１】　情報が記録されているディスクの記録面に光スポットを照射するための少なくとも発光手段、受光手段、集光手段などの光学部品と前記光学部品を保持するホルダ等を有する可動体と、前記可動体を前記ディスクの半径方向及びディスク平面と直交する方向の２方向に駆動する駆動手段と、前記可動体を前述の２方向に移動可能に支持する支持手段などからなる光学部品駆動装置において、
前記支持手段は弾性及び粘性を有する前記ディスクと非平行な少なくとも４枚以上の板で構成されており、前記板が一端を前記発光手段、前記受光手段、前記駆動手段と電気的に接続し、他端を前記光学部品駆動装置の外部回路と電気的に接続する複数の配線を有する事を特徴とする光学部品駆動装置。

【請求項２２】　情報が記録されているディスクの記録面に光スポットを照射するための少なくとも発光手段、受光手段、集光手段などの光学部品と前記光学部品を保持するホルダ等を有する可動体と、前記可動体を前記ディスクの半径方向及びディスク平面と直交する方向の２方向に駆動する駆動手段と、前記可動体を前述の２方向に移動可能に支持する支持手段などからなる光学部品駆動装置において、
前記支持手段は弾性を有する少なくとも４枚以上の板と、少なくとも４本以上の補強部材とで構成し、前記板は前記ディスクと非平行であり、かつ前記板と前記可動体との接合面と、前記板の固定部材との接合面とが非平行に構成し、
前記板が一端を前記発光手段、前記受光手段、前記駆動手段と電気的に接続し、他端を前記光学部品駆動装置の外部回路と電気的に接続する複数の配線を有する事を特徴とする光学部品駆動装置。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】本発明は、特に光記録再生装置における光学部品駆動装置に関する。
【０００２】
【従来の技術】従来の光記録再生装置において板バネを用いた種々の光学部品駆動装置が用いられているが、それらの光学部品駆動装置は、例えば実公昭６２－２０９０３に示されるごとく可動体を２対の板バネで支持している。
【０００３】
【発明が解決しようとする課題】しかしながら、前述の例では２方向に可動体を移動可能に支持するために必要な２対の板バネを接合する中継支持部材が不可欠となり、可動体の軽量化を阻害し、また複雑な構造により動特性が不安定であるという問題があった。
【０００４】また、可動体に発光素子、受光素子などの光学素子を一体化した場合にはこれら素子への電気的配線が不可欠であり、いっそう複雑かつ動特性が不安定な構造になるという問題があった。
【０００５】
【課題を解決するための手段】本発明の情報が記録されているディスクの記録面にスポット光を照射するための光学部品と前記光学部品を保持するホルダ等を有する可動体と、前記可動体を前記ディスクの半径方向及びディスク平面と直交する方向の２方向に駆動する駆動手段と、前記可動体を支持する支持手段などからなる光学部品駆動装置は前記支持手段は弾性を有する少なくとも４枚以上の板バネで構成されており、かつ前記板バネの幅方向が前記ディスク平面と任意の角度をもち、また、前記板バネを各種信号の配線材と一体に構成した事を特徴とする。
【０００６】
【実施例】
（実施例１）図１に本発明における第１の実施例を示す。
【０００７】光源２から発生した光１５はコリメートレンズ３により平行光とされ、その後、光路変更手段４によりディスク１平面と直交する方向に屈折され、さらに対物レンズ５を介して記録面上の任意の位置に光スポットを形成する。ところが前記ディスク１は主軸モータ６の主軸の振れ、ディスク自体の偏心や面振れなどの影響により半径方向（以下トラッキング方向、矢印２２で示す）及びディスク面と垂直方向（以下フォーカシング方向、矢印２１で示す）に移動するため、その変位に合わせて対物レンズ５を有する可動体は駆動される。
【０００８】ここで、前記可動体は前記対物レンズ５と、それを保持するホルダ７と、可動体をフォーカシング方向に駆動する第１のコイル８ａ．ｂとトラッキング方向に駆動する第２のコイル９ａ～ｄなどから構成されている。
【０００９】また、前記可動体は図２に示すように弾性を有する４枚の板バネ１０ａ～ｄの一端で支持されている。この時、板バネ１０ａ～ｄはそれぞれ、その幅方向がディスク１の平面と任意の角度３１ａ～ｄをもっており、板バネ１０ａ～ｄの他の一端はベース１１に固定されているために、図３で示す様に４枚の板バネがフォーカシング方向、トラッキング方向の２方向に曲がり、可動体は前記２方向に移動可能となる。また角度３１は可動体の前記２方向以外の、例えば前記ディスクの接線方向軸周りの板バネの剛性を向上する。
【００１０】ここで、板バネ１０の材質及び形状について説明する。板バネ１０の材質は例えばステンレス鋼、りん青銅やベリリウム銅などの弾性を有する金属材料が望ましく、その断面形状は厚さ０．００５ｍｍから１ｍｍ、幅０．１ｍｍから２ｍｍの概矩形もしくは台形をしている。また、前記板バネ１０はプラスチック材料でも良いが、温度特性や経時変化の点から前述の様な金属材料の方が有効である。
【００１１】次に角度３１について説明する。角度３１はその大きさによってフォーカシング方向及びトラッキング方向のバネ定数を左右する。すなわち、角度３１の値が０度に近づけば近づくほどフォーカシング方向のバネ定数は小さくなる反面、トラッキング方向のバネ定数は大きくなる。その逆に、角度３１が９０度に近づくとフォーカシング方向のバネ定数が大きくなりトラッキング方向は小さくなる。ここで、前記バネ定数はフォーカシング方向およびトラッキング方向への可動体の動特性に大きく影響を与えるため、それを左右する角度３１の値は重要となり、その値は４つともそれぞれ等しく、２５度から６５度が有効である。
【００１２】なお、本実施例においては４枚の板バネによって可動体を支持しているが、図４に示すように４枚

の板バネを例えば２部品によって構成する事によっても同等の効果を得る。

【００１３】次に駆動手段について説明する。

【００１４】図１で示すように可動体をフォーカシング方向に駆動する第１のコイル８は空芯長円形をしていて対向する磁石１２から発生する磁束との電磁作用によりフォーカシング方向に駆動力を発生する。前記第１のコイル８ａ，ｂはディスクの接線方向に沿った方向の前記ホルダ７の両側面にそれぞれ１つずつ固着されており前記駆動力により可動体をフォーカシング方向に駆動する。また、トラッキング方向に駆動する第２のコイル９は前述の第１のコイル８と同様に空芯長円形をしており、対向する磁石１２の発生する磁束との電磁作用で可動体を駆動する。前記第２のコイル９ａ～ｄも第１のコイルと同様に前記ホルダ７の前記両側面にそれぞれ２つ、計４つずつ固着されている。また、前記磁石１２ａ，ｂは前記第１及び第２のコイル８と９と所望の空隙をもって固定部に配置されている。

【００１５】ここで、前記第１及び第２のコイル８と９は銅またはアルミニウムなどの導電体を主たる成分とした金属線材を巻いたものであるが、例えばポリイミド樹脂やポリウレタン樹脂等の絶縁シート上に前記導電材料をパターン形成したものでも同様の効果を得る。また、本実施例においてはホルダ７に第１及び第２のコイル８と９を搭載し、磁石１２を固定部に配置しているが、磁石１２をホルダ７に搭載し、前記第１及び第２のコイル８と９を固定部に配置しても同様である。また、本実施例においては、フォーカシング方向への駆動とトラッキング方向への駆動を同一の磁石１２ａ，ｂを用いているが、前述の２方向へ駆動する磁石を分割しても同様の効果を得る。さらに、前記第１のコイル８、第２のコイル９及び前述のパターンは概矩形でも同様の効果を得る。

【００１６】（実施例２）図５に本発明における第２の実施例を示す。

【００１７】光源２、光回折手段１４及び対物レンズ５等からなる光学部品はホルダ７に支持されていて、前記ホルダ７とフォーカシング方向に駆動する第１のコイル８とトラッキング方向に駆動する第２のコイル９等から可動体を構成している。

【００１８】光源２から発生した光は光回折手段１４を透過したのち対物レンズ５により集光されディスクの記録面上に光スポットを形成する。この時、光源２から対物レンズ５までの光学部品は前記ホルダ７に搭載されているので、前記可動体がフォーカシング方向またはトラッキング方向に変位しても個々の光学部品の相対位置に変化は生じない。

【００１９】また、可動体は板バネ１０によって支持されており、前記板バネ１０ａ～ｄはそれぞれその幅方向が前記ディスク平面と角度３１を持つようにされていて、なおかつ前記板バネ１０ａ～ｄには粘性を有するダンピング材１３ａ～ｄが固着している。これによっても実施例１と同様の効果をえる。

【００２０】ここで、前記ダンピング材１３について説明する。前記ダンピング材１３は例えばシリコンゴム、天然ゴム、ブチルゴムやエーテル系ポリウレタンを主成分としていて、前記可動体の変位にともなう前記板バネ１０の不要な変形エネルギをダンピング材１３の粘性抵抗により抑制する。ところで、前記ダンピング材１３は前記板バネ１０の全部に固着しても良いが、一部にのみ固着しても効果を得る。また、図６で示すように２枚の板バネの間に前記ダンピング材を充填することによっても前述と同じ効果を得る。さらに、板バネ間の一部を充填することによっても同様の効果を得る。

【００２１】（実施例３）図７に本発明における第３の実施例を示す。

【００２２】前記ディスクの接線方向にそった前記可動体を構成するホルダ７の両側面にそれぞれ４枚、計８枚の前記板バネ１０ａ～ｈの一端を固着し、前記板バネ１０ａ～ｈのそれぞれ他の一端を固定部に固定する。この時、前記板バネ１０ａ～ｈはその幅方向が前記ディスクの平面と角度３１を持つようにする。これによっても、実施例１と同様の効果を得る。また、長手方向が一致する２枚の板バネ、例えば１０ａと１０ｅを１枚の板バネで形成し、同様に他の６枚の板バネもそれぞれ３枚の板バネで形成することによっても上述と同様の効果を得る。

【００２３】（実施例４）図８に本発明における第４の実施例を示す。

【００２４】幅方向が前記ディスク平面と前記角度３１を持つように固着した４枚の板バネ１０ａ～ｄが前記ホルダ７と前記ベース１１との間の一部または全部において、その長手方向が前記ディスクの接線方向（矢印２３で示す）と非平行であり、図８（ａ）に示すごとく上面から見たとき、および図８（ｂ）に示すごとく側面から見た場合においても左右の板バネ１０はそれぞれ概ハの字上に配置されている。この構造においても実施例１と同様の効果を得る。また、本実施例においてはベース１１側が幅広となっているが、ホルダ７側を幅広に、ベース１１側を狭くしても同様である。

【００２５】なお、本発明の実施例として、光記録再生装置における光学部品駆動装置の場合を例にとって説明したが、各種機器に用いられる光学部品駆動装置においても同様の効果を得る。

【００２６】（実施例５）図９（ａ）は本発明における第５の実施例の概要図である。

【００２７】固定部材１０９は光学ユニット１０２、反射機構１０３、レンズ１０４、コイル１０６を備える可動体１０１を、４個の板バネ１０５ａ、１０５ｂ、１０５ｃ、１０５ｄ（図９（ｂ）に図示してある。）を介して可動支持している。光学ユニット１０２より出射した

光は反射機構１０３でレンズ１０４に向かい、レンズ１０４を通って記録媒体（図示されていない。）に集光する。記録媒体より反射した記録情報を含む光は前記の光路を逆に辿り光学ユニット１０２に戻り、光学ユニットは戻った光から電気的信号を生成する。この電気信号をもとに、コイル１０６に流れる電流によりコイル１０６と磁石１０７の間に発生する電磁力を用いて可動体の位置制御を行っている。

【００２８】図１０は本実施例の説明図であり、板バネ１０５の動作を説明するために簡略化して図示してある。図１０（ａ）は中立位置の状態を示している。このとき板バネ１０５ａ、１０５ｂ、１０５ｃ、１０５ｄの変形は小さい。

【００２９】一方、図１０（ｂ）は可動体１０１が動きうるフォーカシング方向及びトラッキング方向の内、一例として矢印２０１の方向に変位した状態を示している。このとき板バネ１０５ａ、１０５ｂ、１０５ｃ、１０５ｄは各々捻れ変形と撓み変形を複合した変形モードで変形する。

【００３０】本実施例の制作の際、このような変形モードにおいては各々の板バネの幅や厚さによって挙動が大きく異なることが解った。そこで実験を進めた結果、図１１に示すように板バネの長さＬが幅Ｗの８倍以上の場合、偏平率（幅Ｗに対する厚さＴの比率＝Ｔ／Ｗ）が７％以上の形状であれば板バネの挙動は安定し、偏平率が７％以下の形状であれば板バネの挙動が不安定となる事を発見した。さらに、図１１の表に示すように偏平率が１６％以上であれば安定性が極めて向上する事も発見した。

【００３１】図１２は本実施例における板バネの応用例である。斜線部は可動体１０１及び固定部材１０９との取り付け部分である。図１２（ａ）は図１１で示した長さＬと幅Ｗを示してあり、これは最も単純な実現形状である。

【００３２】図１２（ｂ）は取り付け部分の幅Ｗ１に対して板バネ中央の直線部分の幅Ｗ２が小さい応用例である。これは板バネの厚さＴが比較的大きい材料を使用する場合に、板バネの剛性が高くなることによる動作の不具合を防止するために有効である。このときの挙動の安定性に係る偏平率はＴ／Ｗ２である。

【００３３】図１２（ｃ）は板バネの両端部に、板バネ中央の直線部分の幅Ｗ３に対して幅の狭い狭幅部がある応用例である。これは板バネの厚さＴが比較的小さい材料を使用する場合に、板バネの剛性が低くなることによる動作の不具合を防止するために有効である。このときの挙動の安定性に係る偏平率はＴ／Ｗ４である。

【００３４】図１２（ｄ）は図１２（ｃ）の板バネ中央部の幅を一定にしない応用例である。中央部の幅がＷ５からＷ４まで変化しているが、これは板バネの固有振動数を分散させる効果があり、固有振動周波数における振幅のピークを低くする効果があるので制御上有効である。

【００３５】図１３は本実施例の応用例であり、図１２（ｃ）の板バネを組み合わせたものである。可動体１０１が動きうるフォーカシング方向及びトラッキング方向の内、一例として矢印５０１の方向に変位した状態を示している。このとき板バネは狭幅部５０２ａが捻れ変形し、中央部５０２ｂが撓み変形する。このように板バネの両端に狭幅部を設けることにより変形モードが分散し、動作が安定するとともに線形動作範囲が広がる。また実験の結果、本応用例においては固有振動数に対して単純な撓み剛性の影響が支配的であり、設計上配慮する剛性は撓み剛性でよいことが確認された。

【００３６】図１４は本実施例における板バネ中を通す配線の一例である。図１４（ａ）に示すように、板バネ１０５には配線６０１が４本板バネ１０５の一端より他端に向かって略平行に並んでいる。この配線６０１はベリリウムを含有する銅合金バネ材料の箔からエッチングにより成形し、図１４（ｂ）の断面図に示すように断面形状は略長方形である。

【００３７】図１４（ｂ）に示すように本実施例の板バネ１０５の外形はポリイミド樹脂を配線の両面より塗布する事により成形している。材料はポリイミド樹脂以外にも絶縁性を有する材料の使用が可能である。また、製造方法は樹脂の塗布以外にシート状材料の張り付けや、射出成形によっても可能である。

【００３８】さらに、一例として図１４（ｃ）に示すように配線６０１を積層し、また配線６０１ａのように断面積の異なる配線と組み合わせることも可能である。

【００３９】図１４（ａ）に示した板バネ１０５の狭幅部６０２においては外形端面に配線６０１が露出する可能性があるが、４本の板バネ１０５は互いに接触しないので問題ない。

【００４０】本実施例における配線６０１は、４本の板バネ１０５の各々に４本、合計１６本ある。図９（ｂ）に示すように板バネ１０５ａ、１０５ｂ、１０５ｃ、１０５ｄは乖離しているので板バネ間での電気的影響は小さいが、板バネ１０５の中にある近接した４本の配線６０１間では電気的影響を受けやすい。そこで本実施例においては光学ユニット１０２から出力する受光信号線と光学ユニット１０２に入力する光源駆動信号線と可動体１０１を駆動するコイル１０６に電流を供給するコイル駆動信号線という電流レベルの異なる信号線を同一の板バネ中に配置していない。具体的には板バネ１０５ｃ、１０５ｄに受光信号線をまとめ、板バネ１０５ｂに光源駆動信号線をまとめ、板バネ１０５ａにコイル駆動信号線をまとめて配置している。このように信号線を配置することにより安定した制御動作を実現した。

【００４１】（実施例６）図１５は本発明における第６の実施例である。

【００４２】図１５（ａ）に示すように本実施例の板バネ７０１ａ～ｄは固定部材７０２に可動体７０３をフォーカシング方向（矢印２１）及びトラッキング方向（矢印２２）の２方向に可動支持している。

【００４３】本実施例の特徴はこの板バネ７０１ａ～ｄの取り付け方にある。板バネ７０１ａ～ｄの固定部材７０２側の端部は固定部材７０２のトラッキング方向と垂直な端面に接合し、板バネ７０１ａ～ｄは固定部材７０２側から可動体７０３に向かって約９０°捻れ、板バネ７０１ａ～ｄの他端は可動体７０３のフォーカシング方向と垂直な端面に接合する。板バネ７０１ａの捻れを矢印７０４から見た形状を図１５（ｂ）に示してある。

【００４４】本実施例において４枚の板バネ７０１ａ～ｄはトラッキング方向と垂直な対称面とフォーカシング方向と垂直な対称面を有するように配置してある。

【００４５】図１６は本実施例の動作説明図である。図１６（ａ）～（ｃ）は各々固定部材７０２側が固定され、可動体７０３側が矢印８０１、８０２、８０３の方向に変位したときの板バネ７０１ａの状態を示している。

【００４６】矢印８０１方向の変位よって板バネ７０１ａは主に可動体７０３側端部付近が撓み変形し、矢印８０２方向の変位よって板バネ７０１ａは主に固定部材７０２側端部付近が撓み変形し、矢印８０３方向の変位よって板バネ７０１ａは主に変位位置８０４で示した中央部付近が撓み変形する。このように、板バネ７０１ａ～ｄは可動体７０３が動きうるフォーカシング方向とトラッキング方向によって作られる平面内のあらゆる方向に対しても平面撓みが発生する部分を有しているので、小さい駆動力で可動体７０３を駆動することが可能となるとともに、等方的な性能を得ることができる。

【００４７】また、図１５の板バネ７０１ａ～ｄの取り付け方とは異なるが、板バネ７０１ａ～ｄの固定部材７０２側の端部を固定部材７０２のフォーカシング方向と垂直な端面に接合し、板バネ７０１ａ～ｄの他端を可動体７０３のトラッキング方向と垂直な端面に接合することによっても同様の効果を得る。

【００４８】さらに、板バネの配置は図８のようにベース１１の側すなわち本実施例における固定部材７０２の側を広げる配置によっても同様の効果を得る。

【００４９】（実施例７）図１７は本発明の第７の実施例である。

【００５０】本実施例は第６の実施例における板バネ７０１ａ～ｄが約９０°捻れているのに対して、９０°より小さい捻れ角度にしていることが特徴である。捻れ角度の一例として本実施例では４５°の場合を示しているが、制御上の必要に合わせて適切な角度を選択することができる。

【００５１】板バネ７０５ａ～ｄの固定部材７０２側の端部は固定部材７０２のトラッキング方向と垂直な端面に接合し、板バネ７０５ａ～ｄは固定部材７０２側から可動体７０６に向かって約４５°捻れ、板バネ７０５ａ～ｄの他端は可動体７０６のフォーカシング方向と垂直な平面と約４５°の角度を持ち、ディスクの接線方向（矢印２３）と平行な端面に接合する。板バネ７０５ａの捻れを矢印７０７から見た形状を図１７（ｂ）に示してある。捻れ方向は逆であっても同様の効果を得る。

【００５２】このように構成し、板バネの捻れ角を所望に設定することにより、駆動系と支持系剛性のバランスを合わせることが容易にできるので最適制御が可能となる。

【００５３】また、板バネ７０５ａ～ｄの固定部材７０２側の端部を固定部材７０２のフォーカシング方向と垂直な端面に接合し、他端を可動体７０６のフォーカシング方向と垂直な平面と所望の角度を持ち、ディスクの接線方向（矢印２３）と平行な端面に接合する事によっても同様の効果を得る。

【００５４】さらに、板バネ７０５ａ～ｄの可動体７０６側の端部を可動体７０６のフォーカシング方向と垂直な端面またはトラッキング方向と垂直な端面接合し、他端を固定部材７０２のフォーカシング方向と垂直な平面と所望の角度を持ち、ディスクの接線方向（矢印２３）と平行な端面に接合する事によっても同様の効果を得る。

【００５５】（実施例８）図１８は本発明の第８の実施例である。

【００５６】本実施例は等方的性能を有する第６の実施例に対して、剛性を上げるために補強部材としてワイヤ７０８ａ～ｄを追加したことを特徴としている。

【００５７】図１８（ａ）に示すように板バネ７０１ａ～ｄは、固定部材７０２側の一端が固定部材７０２のトラッキング方向と垂直な端面に接合し、固定部材７０２側から可動体７０９に向かって約９０°捻れ、他端が可動体７０９のフォーカシング方向と垂直な端面に接合している。

【００５８】また、ワイヤ７０８ａ～ｄは固定部材７０２側の一端を固定部材７０２のトラッキング方向と垂直な端面に接合し、他端を可動体７０９のトラッキング方向と垂直な端面に接合する。ワイヤ７０８ａ～ｄは互いに平行かつメディアの接線方向に平行になっており、板バネ７０１ａ～ｄと同様に可動体７０９が動きうるフォーカシング方向とトラッキング方向によって作られる平面内のあらゆる方向に対して等方的な剛性を持っている。

【００５９】図１８（ｂ）は矢印７１０から見た本実施例の部分拡大図であり、板バネ７０１ａ、７０１ｃとワイヤ７０８ａ、７０８ｃの位置関係を示している。

【００６０】このように構成することにより、電気的配線を兼ねた板バネにおいてコスト上有利な規格材料を選択しながら安価なワイヤにより所望の剛性を得ることが

できる。

【００６１】（実施例９）図１９は本発明の第９の実施例である。

【００６２】本実施例は、４本のワイヤ７０８ａ～ｄで可動支持した可動体７０９の側面２箇所に配線部材８０１ａ、８０１ｂを配置したものである。このような構成においては動作性能の安定性から、配線部材の弾性はワイヤの弾性に比べて十分に小さい事が望ましい。

【００６３】本実施例における配線部材は、図１９（ｂ）に示すように複数の配線８０２の両端を絶縁材８０３で一体とし、さらに中間に中間絶縁材８０４を配置し各配線間の接触を防止しながら、低い弾性を実現している。配線８０２は所望の断面形状であれば、例えば被覆銅線のように別の絶縁材で被覆されていても良い。また、配線８０２の材料は導電材料でよいが、耐久性向上のためには例えばベリリウム銅のような銅系のバネ材料が望ましい。

【００６４】中間絶縁材８０４には例えばゴムのように粘性を有する材料を用いる事により振動の減衰をはかり、動作の安定性を向上させている。

【００６５】また、中間絶縁体８０４に弾性のさらに低い粘性材料を用いれば、配線８０２の全体を覆う事も可能である。

【００６６】次に信号について述べる。本実施例においては可動体７０９を駆動する駆動手段（図示していない）への駆動信号線と可動体７０９内の発光手段（図示していない）への駆動信号線を配線手段８０１ａにまとめ、可動体７０９内の受光手段（図示していない）からの信号線を配線手段８０１ｂにまとめ、特に受光手段からの信号に対してのノイズを低減している。

【００６７】

【発明の効果】以上説明したように、本発明は板バネの幅方向とディスク平面とに角度を持たせ、単純な構成の板バネで可動体をフォーカシング方向及びトラッキング方向の２方向に変位可能にした事により、中継支持部材を不要にし、構造の簡素化を実現した。

【００６８】また、支持手段である板バネが複数の電気配線の機能を兼ねることにより、従来支持系とは別に必要であった配線を無くすことができた。これはコスト上極めて有利である。

【００６９】板バネを捻れ状態で使用する事により、剛性を下げる、剛性に異方性を与えるなど制御目的に合わせて特性を容易に変更できるので、最適制御を実現できるとともに、主要な構成を変更せずに広範囲な機器への応用が可能な光学部品駆動装置を実現した。

【図面の簡単な説明】

【図１】本発明の実施例１を示す斜視図。

【図２】（ａ）は本発明の実施例１を示す上面平面図、（ｂ）は図１０（ａ）で示すＸ－Ｘ’断面図。

【図３】（ａ）は本発明の実施例１の駆動状態を示す上面平面図、（ｂ）は本発明の実施例１の駆動状態を示す側面図。

【図４】本発明の実施例１の板バネの一例を示す斜視図。

【図５】本発明の実施例２を示す斜視図。

【図６】本発明の板バネとダンピング材の構成を示す断面図。

【図７】本発明の実施例３を示す斜視図。

【図８】（ａ）は本発明の実施例４を示す上面平面図、（ｂ）は本発明の実施例４を示す側面図。

【図９】（ａ）は本発明の実施例５を示す斜視図、（ｂ）は本発明の実施例５を示す部分斜視図。

【図１０】（ａ）は本発明における実施例５の待機状態説明図、（ｂ）は本発明における実施例５の変位状態説明図。

【図１１】本発明における偏平率の説明図。

【図１２】（ａ）、（ｂ）、（ｃ）、（ｄ）は本発明における板バネ応用例の外形図。

【図１３】本発明における実施例５の応用例説明図。

【図１４】（ａ）は本発明における板バネの配線図、（ｂ）、（ｃ）は本発明における板バネの断面図。

【図１５】（ａ）、（ｂ）は本発明における実施例６の説明図。

【図１６】（ａ）、（ｂ）、（ｃ）は本発明における実施例６の動作説明図。

【図１７】（ａ）、（ｂ）は本発明における実施例７の説明図。

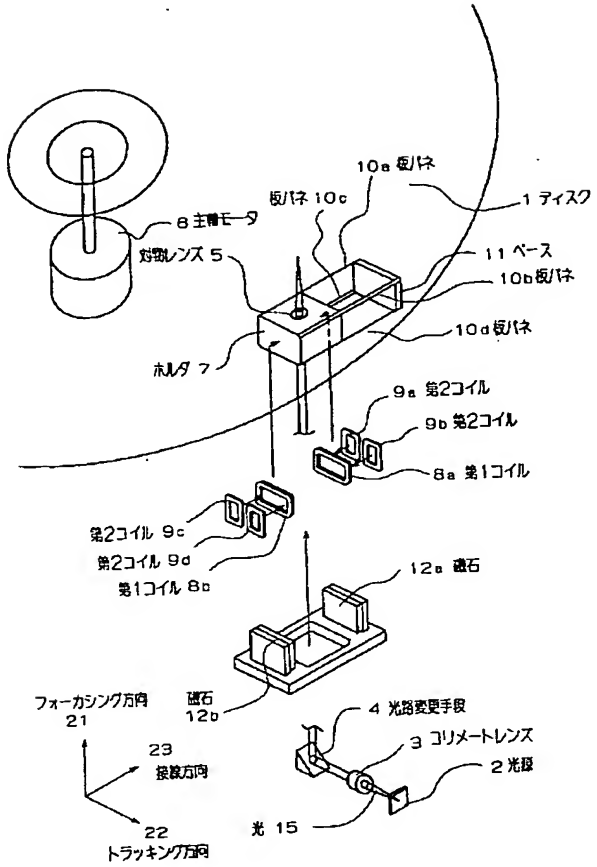
【図１８】（ａ）は本発明における実施例８の説明図、（ｂ）は本発明における実施例８の部分拡大図。

【図１９】（ａ）、（ｂ）は本発明における実施例９の説明図。

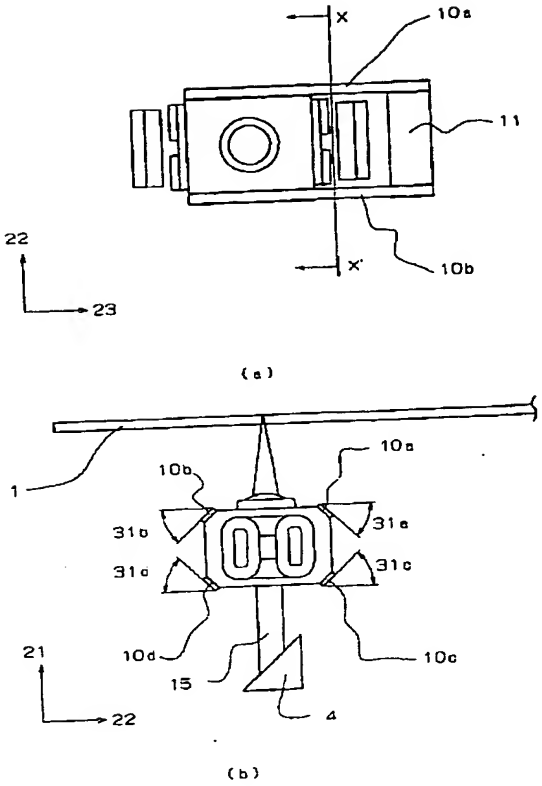
【符号の説明】

１　ディスク
２　光源
３　コリメートレンズ
４　光路変更手段
５　対物レンズ
６　主軸モータ
７　ホルダ
８　第１のコイル
９　第２のコイル
１０　板バネ
１１　ベース
１２　磁石
１５　光
２１　フォーカシング方向
２２　トラッキング方向
２３　ディスクの接線方向

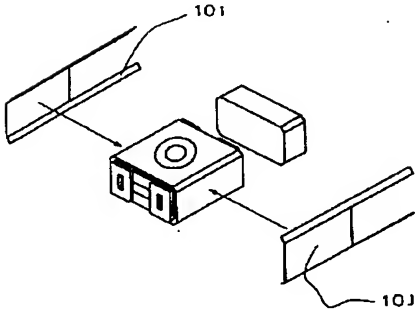
【図１】



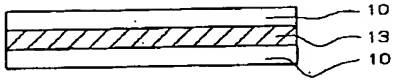
【図２】



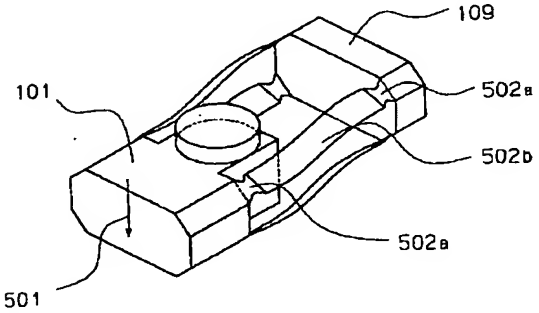
【図４】



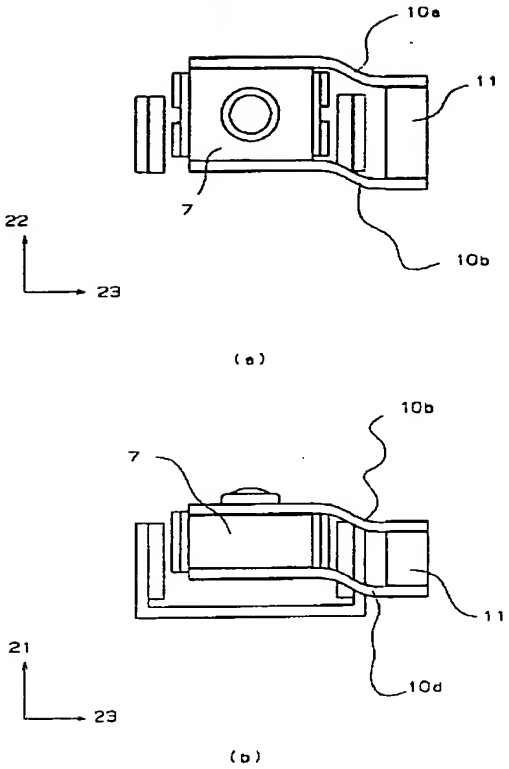
【図６】



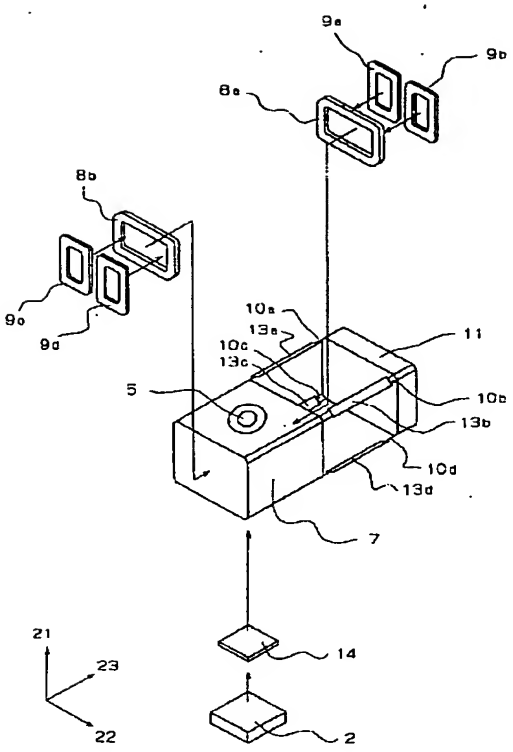
【図１３】



【図３】

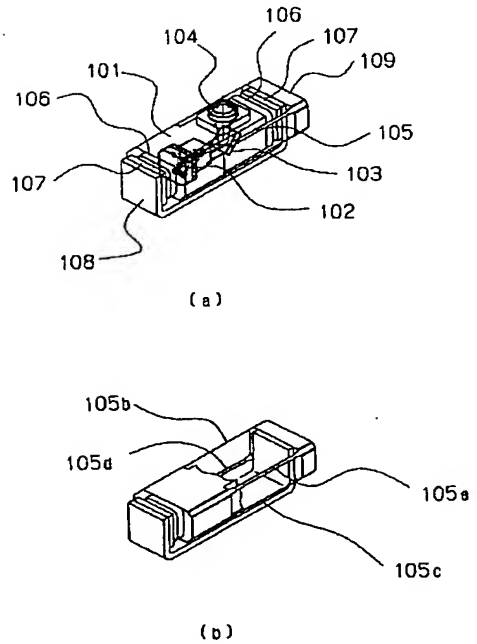

10a
11
7
10b
22
23
(a)
10b
7
11
10d
21
23
(b)

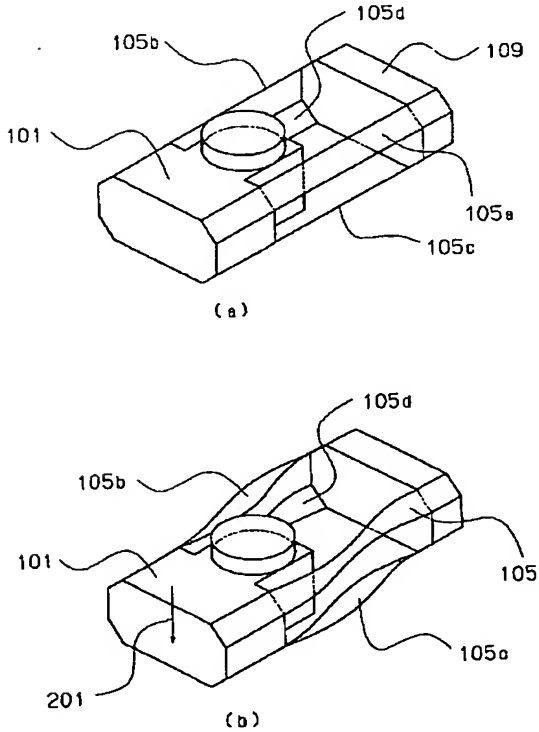
【図５】


9a
9b
8a
8b
9c
9d
10a
13a
10c
13c
11
5
10b
13b
10d
13d
7
14
2
21
23
22

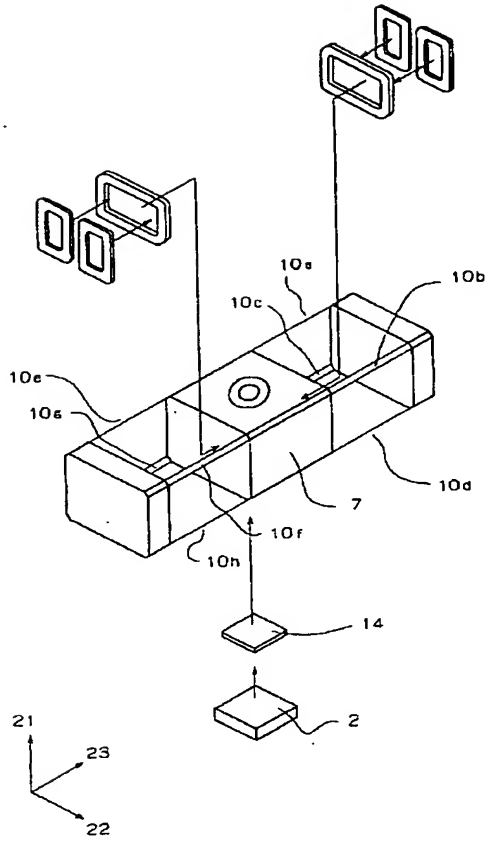
【図１０】

【図９】

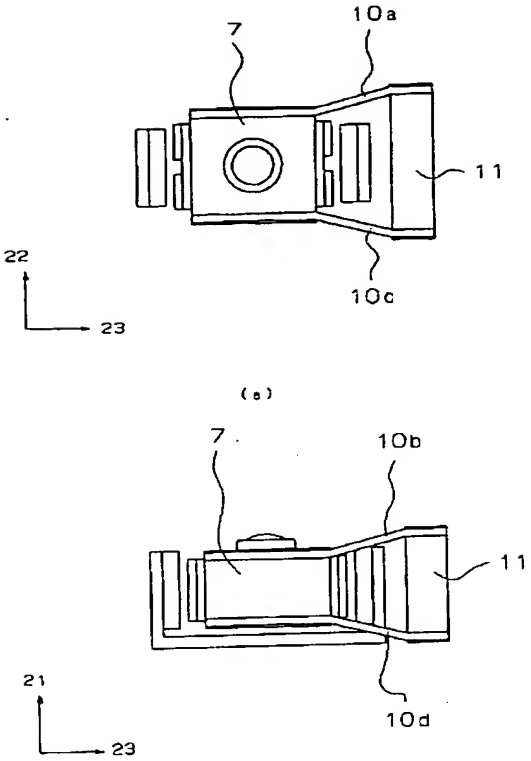

106
104
107
101
109
106
105
107
103
102
108
(a)
105b
105d
105a
105c
(b)


105d
105b
109
101
105a
105c
(a)
105d
105b
101
105a
105c
201
(b)

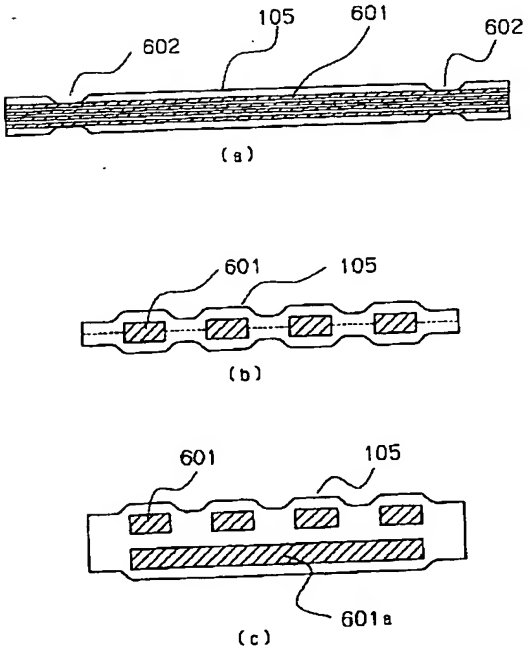
【図７】


10a
10b
10c
10e
10g
10d
7
10f
10h
14
2
21
23
22

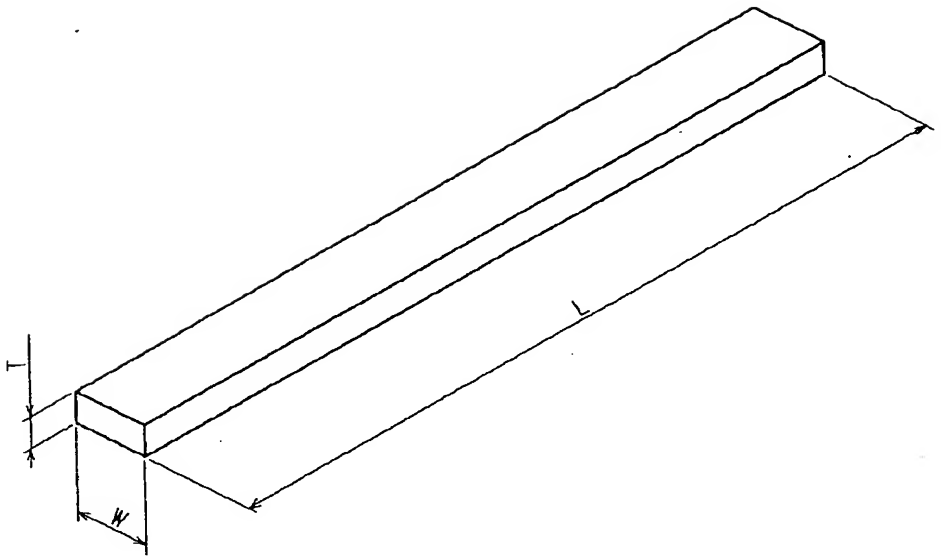
【図８】


7
10a
11
10c
22
23
(a)
7
10b
11
10d
21
23
(b)

【図１４】

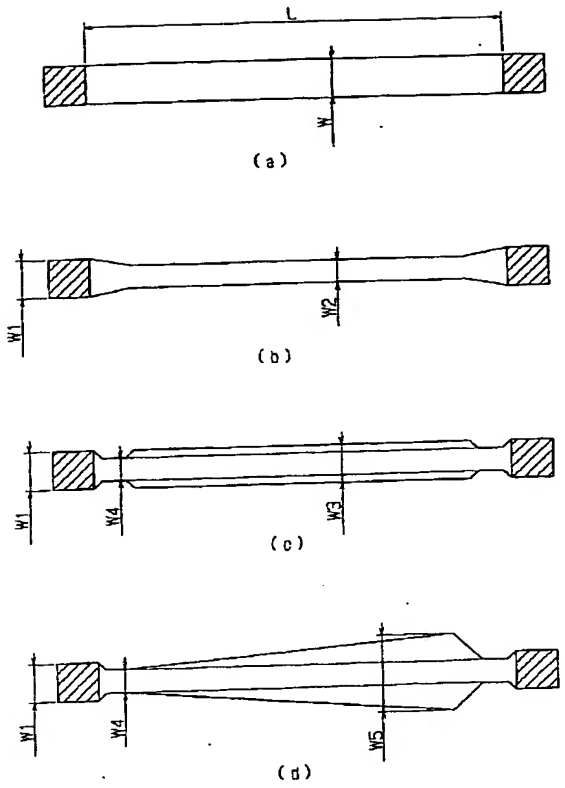

105
601
602
602
(a)
601
105
(b)
601
105
601a
(c)

【図１１】

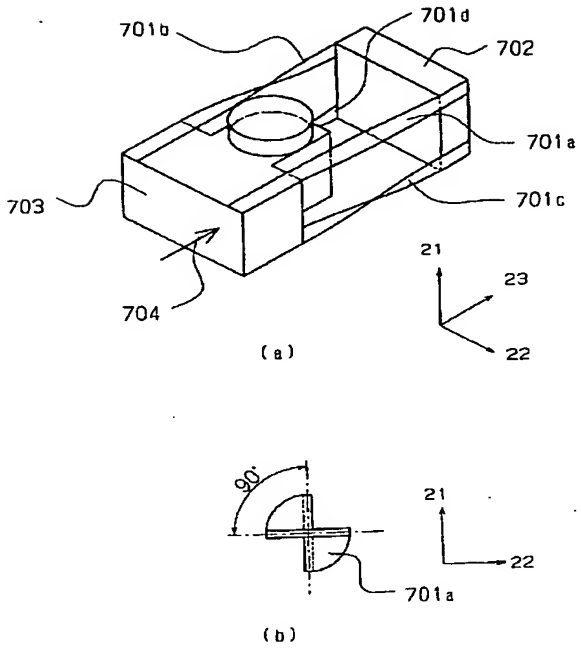


扁平率 T/W(%)	5	7	10	16
動作の安定性	×	△	○	◎

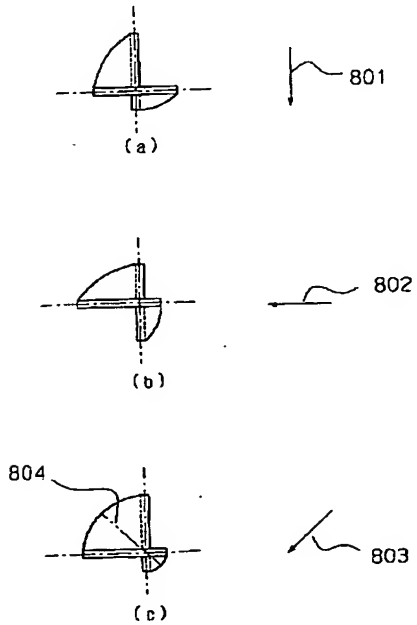
【図１２】



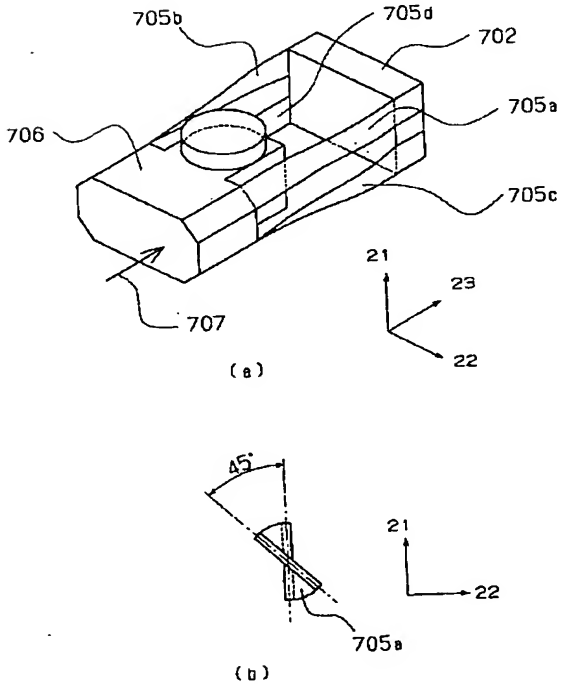
【図１５】



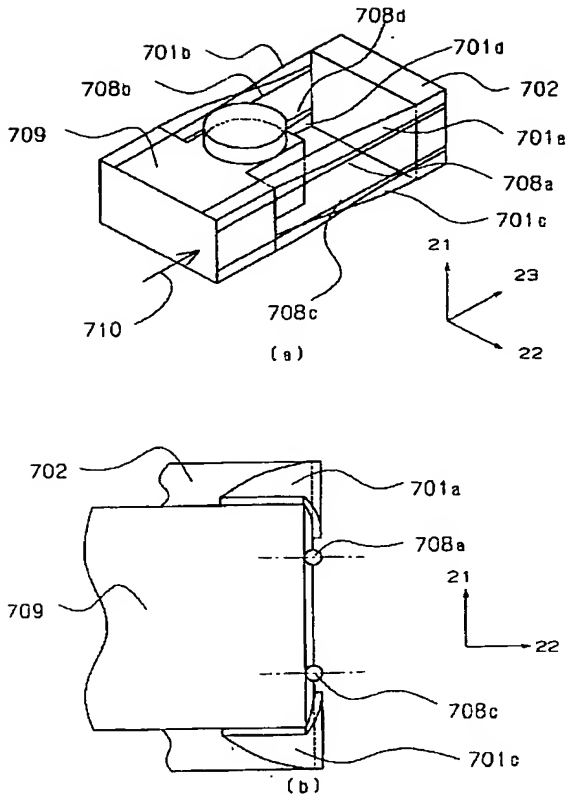
【図１６】



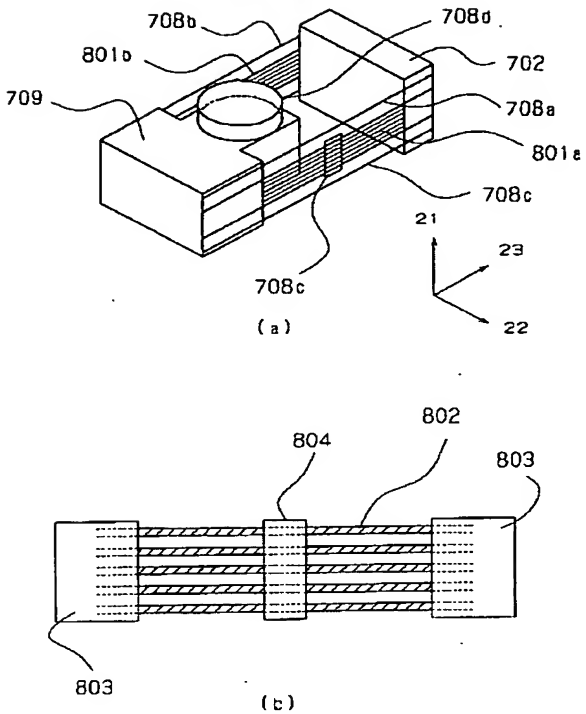
【図１７】



【図１８】


708d
701b
701d
708b
702
709
701e
708a
701c
21
23
710
708c
22
(a)
702
701a
708a
21
709
22
708c
701c
(b)

【図１９】


708b
708d
801b
702
709
708a
801c
708c
21
23
708c
22
(a)
802
804
803
803
(c)